AMSAT News Service Weekly Bulletins
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SB ALL @ AMSAT $ANS-216.01
UPDATE ON UOSAT/MICROSAT BBS

HR AMSAT NEWS SERVICE BULLETIN 216.01 FROM AMSAT HQ
SILVER SPRING, MD AUGUST 4, 1990
TO ALL RADIO AMATEURS BT

UoSAT / Microsat BBS Passes Alpha Tests

During "Colloquium Week" at the University of Surrey (UoS), Harold Price, NK6K and Jeff Ward, G0/K8KA, made significant progress in testing store and forward communications software on UO-14. This software will also be run on AO-16 and LO-19 after it has been completely tested and debugged on UO-14.

Once Harold arrived at UoS, he and Jeff went directly to work loading the 210 kbytes of code to UO-14 for testing. The tasks loaded were: hit.exe (the Housekeeping Integration task), cpe.exe (the Cosmic Particle Experiment data collector), mfile.exe (the RAMDISK file system server), tlm.exe (the telemetry server), qax25.exe (the AX.25 "virtual TNC") and ftl0.exe (the BBS itself "File Transfer Level 0").

During the course of the week, it was necessary to re-load the software 5 times, to overcome operational glitches and install bug fixes. When the satellite wasn't in range, memory dumps were examined and new code versions were compiled and ground-testing. For ground tests Jeff and Harold used 2 IBM Real-Time Interface Co-processor cards (in their respective PCs) and the UO-14 engineering model (at least the bits of it which would fit onto Jeff's desk).

To stress the software and reveal bugs, they started a bulletin broadcast, which fills any free downlink time with UI frames. With this running, they connected to the BBS and downloaded a 30 kbyte file. Throughout the test, European stations continued digipeating. After downloading the file twice without incident, the 'alpha tests' were declared complete.

The success of the hard work performed by Harold and Jeff now clears the way for the following activities:

(1) Release of the UoSAT/Microsat PACSAT protocol specifications. Complete definitions of PACSAT File Headers, PACSAT Broadcast format, and the File Transfer protocol Level 0 will be freely available. All of these have been in draft form for some time, and Harold is getting final versions ready for publication in the ARRL Networking Conference proceedings. If all goes well, they should also be available in electronic format in early fall.

(2) Development of user groundstation software for BBS access. The FTL0 protocol is designed for automated access (not hunt-and-peck keyboard control). Once fully tested, this software will be made available through AMSAT-UK and AMSAT-NA thus making UO-14 truly open for access.

(3) Porting of the file system and the FTL0 BBS to AO-16. Although most of the code will run without modification, there are some differences in satellite hardware and "operating philosophy" which must be accounted for. This specifically involves drivers for the RAMDISKS, and support for ALOHA access on the A0-16. (UO-14 will use an experimental reservation multiple access scheme, with only limited ALOHA contention.)

This is, of course, taking longer than a similar BBS-only effort would on the ground. Remember that UO-14 is simultaneously running six programs:

sampling telemetry, collecting data from the Cosmic Particle Experiment, providing a multiple-connection virtual TNC, broadcasting using a new point-to-multipoint protocol, and waiting for full-duplex binary file transfers at 9600 bits/second. Including DOVE and WEBERSAT, 6 programmers in 2 continents and 4 time-zones have collaborated to bring this together.

[ANS thanks Jeff Ward, G0/K8KA for the information for this bulletin]
/EX
SB ALL @ AMSAT $ANS-216.02
AMSAT-UK COLLOQUIUM, PART 1

HR AMSAT NEWS SERVICE BULLETIN 216.02 FROM AMSAT HQ
SILVER SPRING, MD AUGUST 4, 1990
TO ALL RADIO AMATEURS BT

The following summaries from the AMSAT-UK Colloquium were received from Richard Limebear, G3RWL.

The Colloquium was held at the University of Surrey, England from July 26 to 29, 1990. Over 200 people from about 29 countries were in attendance. This annual event is one of the premier Amateur Satellite sessions held anywhere. Additional details are forthcoming in an upcoming issue of OSCAR News.

* Russian Satellites *

The RS14/RUDAK-2 launch has slipped, the current word is October 1990. Apparently the RSM modulation promised stands for Rectangular Spectrum Modulation but no other information about it is available at this time. The 70cm link will apparently use an RHCP aerial while 2m will use a dipole. Only one transponder will be switched on at a time and that will normally be RUDAK; the analogue transponder is considered to be a reserve.

** BADR-1 New Satellite **

SUPARCO (the Pakistani Space & Upper Atmosphere Research Commission) launched a small UoSAT-2/FO-12 class microsatellite into orbit on 16 July 90.

The Keplerian elements indicate that this orbit is pretty eccentric; as much as FO-20 but a lot lower in altitude. Perigee/apogee at this time are about 198/982 km but by November they'll be 125/900 km - in other words it won't live long. Also, with an inclination of 28 degrees, perigees close to the UK won't rise above the horizon there.

Information received from Suparco says that telemetry is of the UO-11 type; the two transmitters are on 145.825 and 144.028.
/EX
SB ALL @ AMSAT $ANS-216.03
AMSAT-UK COLLOQUIUM, PART 2

HR AMSAT NEWS SERVICE BULLETIN 216.03 FROM AMSAT HQ
SILVER SPRING, MD AUGUST 4, 1990
TO ALL RADIO AMATEURS BT

* FO-20 *

At the Colloquium JARL said they will issue an award for Mode JA operations. It was pointed out that satellite users could do with some more mode JA time; some arrangements were made for this and also for the FO-20 operating schedule to be PUBLISHED in the future.

** ARSENE **

F6BVP gave a comprehensive presentation about their long awaited satellite. ARSENE (Ariane Radioamateur Satellite pour l'ENseignement de l'Espace) will be mounted INSIDE the Ariane rocket's separation collar on the September 1992 flight carrying the Telecom 2B payload. The final orbit is expected to be equatorial with apogee = 36,000 km and perigee = 20,000 km with a period of seventeen and a half hours. Visibility figures for the UK for this type of orbit are "interesting" to say the least - the longest pass seems to be about 31 hours and gaps of 48 hours between passes will occur from time to time.

A solid fuel rocket motor will be used to raise the perigee after launch into Geostationary Transfer Orbit. This spin-stabilised satellite will carry three deployable solar panels and be earth-pointing using nitrogen gas for attitude control; lifetime expected is on the order of five years. The six-sided body will measure 900mm in diameter, be 880mm high and weigh about 140Kg before the kick motor firing.

The communications payload will have a 70cm uplink and 145 and 2445 MHz downlinks; the two modes, B and S, will NOT operate simultaneously. Mode B operation will be FSK packet radio (3 uplink channels, one downlink) and mode S will be a linear transponder.

** AMSAT-Isreal **

Amsat-Israel announced that they intend to follow the example of universities abroad and launch their own satellite project. Plans are for a small store-and-forward spacecraft, perhaps also carrying scientific experiments.
/EX
SB ALL @ AMSAT $ANS-216.04
AMSAT-UK COLLOQUIUM, PART 3

HR AMSAT NEWS SERVICE BULLETIN 216.04 FROM AMSAT HQ
SILVER SPRING, MD AUGUST 4, 1990
TO ALL RADIO AMATEURS BT

** UOSAT-F **

There is a proposal for the UoSat-F spacecraft to be launched on an Ariane flight in April 1991. If the proposal is realized, Amsat-UK will make a significant donation to the project which is also hoped to carry a Mode A transponder.

** PHASE-3D **

Design requirements for the Phase-3D satellite were discussed. The plan is to improve links by more than 10dB above AO-13 levels by using more power, more antenna gain, and anti-alligator measures. The preliminary specification has a 250W PEP transmitter in a 3m diameter toroidal shape weighing 400 Kg. Amsat-DL would like it to carry X-band (10GHz) and other microwaves plus experiments and educational features as well as the "normal" communications payloads.
/EX
SB ALL @ AMSAT $ANS-216.05
SAREX IS #1 FOR LAUNCH

HR AMSAT NEWS SERVICE BULLETIN 216.05 FROM AMSAT HQ
SILVER SPRING, MD AUGUST 4, 1990
TO ALL RADIO AMATEURS BT
NASA Has Set Tentative Launch Date for ASTRO-1 / SAREX Mission

NASA will roll out the Shuttle Columbia to the launch pad in the next few days, having repaired the Hydrogen leak that forced a rollback to the VAB (Vertical Assembly Building) in May. Although the final date and time will not be firm until the Final Readiness Review, which is held about a week before launch, a tentative date of September 1 at 5:00 GMT (23:00 EDT on Aug 31 on the Cape) has been set. The night launch should provide dramatic visuals for the sendoff of Ron Parise, WA4SIR, and the SAREX mission.

While Ron is tending to his duties as a Mission Specialist on the ASTRO-1 project, his amateur station will be busy acting as a Packet Radio "QSO-Robot". During his "off time" Ron will be actively making contacts on 2 Meter FM. Ron also plans to spend time communicating directly with school children across the country. A number of schools have been selected to communicate, using amateur radio, to Ron while he is in orbit. This will provide the students the opportunity to ask him questions about his mission as well as space travel in general. In a sense, the long delay of STS-35 can be viewed in a positive manner. Many of the students which will participate in Ron's "classroom visits" will be back in school and not out on vacation as would have been the case if Columbia was launched in July or early August. What a great way to start the school year!

Live Shuttle audio commencing prior to the launch and continuing throughout the entire mission of SAREX will be re-transmitted from the Amateur Radio Club Stations at Goddard Space Flight Center, Greenbelt MD (WA3NAN), the Johnson Space Flight Center, Houston, TX (W5RRR) and the Jet Propulsion Laboratory, Pasadena CA (W6VIO). Stay tuned to ANS for further details as they become available.

[ANS thanks Bill Tynan W3XO, AMSAT VP of Manned Space Programs for the information in this bulletin]
/EX
SB ALL @ AMSAT $ANS-216.06
WO-18 SPACE SCIENCE STUDIES

HR AMSAT NEWS SERVICE BULLETIN 216.06 FROM AMSAT HQ
SILVER SPRING, MD AUGUST 4, 1990
TO ALL RADIO AMATEURS BT

WEBERSAT-OSCAR-18: Space Science + OSCARs = FUN!

Curious hams often wonder if science can be fun. Combine space science with OSCARs and you get an unusual mix of exhilaration and excitement by observing a phenomenon that would be missed in normal daily life. This is what the students at Weber State University (WSU) discovered when they recently noticed that WO-18 was going to pass through a total solar eclipse as its orbit took it over Finland and Siberia. Ground controllers took advantage of this fact and quickly started to prepare to take pictures of this event using WO-18's CCD camera. It was their hope to snap a picture of the earth as WO-18 passed through the penumbra and umbra. Also, the Whole Orbit Data (WOD) telemetry mode was programmed so that solar panel array currents could be recorded and examined later. The very difficult task of planning the telemetry capture and picture taking during this event was quite taxing, however, it paid off as the WOD data revealed that WO-18 did indeed pass through the solar eclipse at the exact predicted time. The CCD camera was programmed to take eleven pictures, one every 13 seconds. The first picture was to be snapped at 02:42:35 UTC on July 22. As WO-18 came back over WSU on the next pass, an immediate dump of the telemetry showed that the their predictions had been perfect. The WOD showed a marked decrease in solar array current. But alas, no pictures were taken which accurately showed what the earth looked like during an eclipse. Although that is what WSU engineers wanted so see the most, this time it was did not happen. Not to be discouraged, in future solar eclipses, WSU engineers plan to do this again until they do snap a picture of the earth

during a eclipse.

In another interesting scientific observation, the microscopic particle impact detector on WO-18 recorded a significant number of collisions during a recent meteor shower! During one day the impact detector noted eleven hits during one orbit. Normally, the impact detector only records two collisions a day! Once again, WSU engineers will be planning WOD operations during future meteor showers as they continue to study this.

Chris Williams (WA3PSD) reports that significant progress has been made in further refining picture taking strategies. WSU engineers now have a better understanding of how to use the information from photo cells to determine when WO-18's CCD camera is looking down at the earth. Also, new software algorithms to decide when to take pictures are being developed.

Finally, WA3PSD announces that WSU will be sending out a beautiful QSL card to those amateurs who have either captured telemetry or a picture from WO-18. Send your hardcopy of telemetry or data to:

WSU/CAST
Eng. Tech. Bldg., Rm #236
3850 Harrison Blvd.
Ogden, UT 84408-1805

WA3PSD joked that white pieces of paper or totally darken pictures don't count. It must be a real picture. Hi! Please include an SASE to expedite the return of your QSL card. For more information about the availability of WeberWare 1.0 which will process the image data from WO-18, contact AMSAT HQ's at (301) 589-6062.
/EX
SB ALL @ AMSAT $ANS-216.07
OPERATIONS NET SCHEDULE

HR AMSAT NEWS SERVICE BULLETIN 216.07 FROM AMSAT HQ
SILVER SPRING, MD AUGUST 4, 1990
TO ALL RADIO AMATEURS BT

AMSAT-NA Operations Net Schedule Announced

AMSAT Operations Nets are planned for the following times. Mode B nets are conducted on an AO-13 downlink frequency of 145.950. Mode J/L nets are conducted on an AO-13 downlink frequency of 435.970.

Date UTC	Time	Phs	Mode	NCS	U.S. Day
07 Aug 90	0130	170	J/L	N5BF	Monday
18 Aug 90	0045	170	J/L	N5BF	Friday
28 Aug 90	0100	169	J/L	N5BF	Monday
08 Sep 90	0020	169	J/L	N5BF	Friday

Acting Operations Net Manager, Courtney Duncan, N5BF, is looking for assistance in running the net in the form of a permanent Net Manager and five or six additional net control stations. To volunteer, contact N5BF at 4522 Ocean View Blvd, La Canada, CA 91011.

For information on the amateur satellite program and how you can participate, contact AMSAT-NA at P.O. Box 27, Washington, DC 20044, phone (301) 589-6062, or contact your local AMSAT Area Coordinator
/EX
SB ALL @ AMSAT $ANS-216.08
AO-13 TRANSPONDER SCHEDULE

HR AMSAT NEWS SERVICE BULLETIN 216.08 FROM AMSAT HQ
SILVER SPRING, MD AUGUST 4, 1990

TO ALL RADIO AMATEURS BT

A new Transponder Schedule for AO-13 was put into effect on July 3.

The present transponder schedule for AO-13 is as follows:

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         Mode-B          : MA 003 to MA 165
         Mode-JL         : MA 165 to MA 190
         Mode-LS         : MA 190 to MA 195  (Mode S Beacon only)
         Mode-S          : MA 195 to MA 200
         Mode-BS         : MA 200 to MA 205
         Mode-B          : MA 205 to MA 240
         Off             : MA 240 to MA 003
         Omni Antennas   : MA 240 to MA 060
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Cross mode B and S QSOs are possible from MA 200 to 205.

The current attitude estimate:
BLON = 207 and BLAT = +1

AMSAT-OSCAR-10 appears to be receiving sufficient solar panel illumination to support Mode-B transponder operations, therefore, the transponder is available for general use whenever AO-10 is in view at your location. Please DO NOT use the transponder if the signals are FMing. The current estimate of AO-10's attitude is   LON 24 deg   LAT -9 deg.

Much activity has been heard on AO-10 centering around a popular calling frequency of 145.910 MHz.
/EX
SB ALL @ AMSAT $ORBS-216.O
Orbital Elements 216.OSCAR

HR AMSAT ORBITAL ELEMENTS FOR OSCAR SATELLITES
FROM N3FKV LORENA, TX   AUGUST 4, 1990
TO ALL RADIO AMATEURS BT

```
Satellite: AO-10
Catalog number: 14129
Epoch time:      90213.38340590
Element set:     537
Inclination:       26.0300 deg
RA of node:       191.8633 deg
Eccentricity:    0.5956580
Arg of perigee:   164.0685 deg
Mean anomaly:     229.3243 deg
Mean motion:    2.05880742 rev/day
Decay rate:      -4.00e-07 rev/day^2
Epoch rev:            5366

Satellite: UO-11
Catalog number: 14781
Epoch time:      90205.02567339
Element set:     762
Inclination:       97.9470 deg
RA of node:       256.3744 deg
Eccentricity:    0.0013301
Arg of perigee:   126.9258 deg
Mean anomaly:     233.3151 deg
Mean motion:   14.65505065 rev/day
Decay rate:       7.91e-06 rev/day^2
Epoch rev:           34136

Satellite: RS-10/11
Catalog number: 18129
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Epoch time:      90213.88937181
Element set:     273
Inclination:       82.9276 deg
RA of node:       294.7635 deg
Eccentricity:    0.0011690
Arg of perigee:     0.1222 deg
Mean anomaly:     359.9925 deg
Mean motion:   13.72099926 rev/day
Decay rate:      -2.50e-07 rev/day^2
Epoch rev:           15571

Satellite: AO-13
Catalog number: 19216
Epoch time:      90207.83376489
Element set:     142
Inclination:       56.9457 deg
RA of node:       143.8599 deg
Eccentricity:    0.6997822
Arg of perigee:   232.2254 deg
Mean anomaly:      41.6809 deg
Mean motion:    2.09704260 rev/day
Decay rate:      -1.61e-06 rev/day^2
Epoch rev:            1623

Satellite: FO-20
Catalog number: 20480
Epoch time:      90210.11254104
Element set:      95
Inclination:       99.0366 deg
RA of node:       248.7026 deg
Eccentricity:    0.0540669
Arg of perigee:   313.6564 deg
Mean anomaly:      42.0895 deg
Mean motion:   12.83157781 rev/day
Decay rate:      -5.00e-08 rev/day^2
Epoch rev:            2212
/EX
SB ALL @ AMSAT $ORBS-216.D
Orbital Elements 216.MICROS

HR AMSAT ORBITAL ELEMENTS FOR THE MICROSATS
FROM N3FKV LORENA, TX      AUGUST 4, 1990
TO ALL RADIO AMATEURS BT

Satellite: UO-14
Catalog number: 20437
Epoch time:      90214.46984135
Element set:     189
Inclination:       98.6975 deg
RA of node:       290.4431 deg
Eccentricity:    0.0011280
Arg of perigee:    25.1180 deg
Mean anomaly:     335.0555 deg
Mean motion:   14.28669130 rev/day
Decay rate:       6.00e-06 rev/day^2
Epoch rev:            2747

Satellite: AO-16
Catalog number: 20439
Epoch time:      90214.52630047
Element set:      99
Inclination:       98.7022 deg
RA of node:       290.6242 deg
Eccentricity:    0.0012147
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Arg of perigee:    25.5608 deg
Mean anomaly:     334.6170 deg
Mean motion:   14.28772305 rev/day
Decay rate:       3.15e-06 rev/day^2
Epoch rev:            2748

Satellite: DO-17
Catalog number: 20440
Epoch time:      90214.45083661
Element set:     102
Inclination:       98.7012 deg
RA of node:       290.5603 deg
Eccentricity:    0.0012180
Arg of perigee:    26.9213 deg
Mean anomaly:     333.2600 deg
Mean motion:   14.28820055 rev/day
Decay rate:       3.28e-06 rev/day^2
Epoch rev:            2747

Satellite: WO-18
Catalog number: 20441
Epoch time:      90210.09544302
Element set:     101
Inclination:       98.7021 deg
RA of node:       286.2426 deg
Eccentricity:    0.0013063
Arg of perigee:    37.8054 deg
Mean anomaly:     322.4043 deg
Mean motion:   14.28910787 rev/day
Decay rate:       2.53e-06 rev/day^2
Epoch rev:            2685

Satellite: LO-19
Catalog number: 20442
Epoch time:      90214.49767531
Element set:     101
Inclination:       98.7012 deg
RA of node:       290.6535 deg
Eccentricity:    0.0013003
Arg of perigee:    26.2010 deg
Mean anomaly:     333.9830 deg
Mean motion:   14.28982489 rev/day
Decay rate:      -2.90e-07 rev/day^2
Epoch rev:            2748
/EX
SB ALL @ AMSAT $ORBS-216.M
Orbital Elements 216.MISC

HR AMSAT ORBITAL ELEMENTS FOR MANNED AND MISCELLANEOUS SATELLITES
FROM N3FKV LORENA, TX      AUGUST 4, 1990
TO ALL RADIO AMATEURS BT

Satellite: SALYUT 7
Catalog number: 13138
Epoch time:      90213.75439440
Element set:     413
Inclination:       51.6012 deg
RA of node:        72.9078 deg
Eccentricity:    0.0001611
Arg of perigee:   107.0310 deg
Mean anomaly:     253.0412 deg
Mean motion:   15.67284358 rev/day
Decay rate:     4.1012e-04 rev/day^2
Epoch rev:           47199
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Satellite: MIR
Catalog number: 16609
Epoch time:      90214.06942670
Element set:     830
Inclination:       51.6117 deg
RA of node:        98.9718 deg
Eccentricity:    0.0010145
Arg of perigee:   210.3673 deg
Mean anomaly:     149.5918 deg
Mean motion:   15.63769492 rev/day
Decay rate:     2.5844e-04 rev/day^2
Epoch rev:           25527

Satellite: HUBBLE
Catalog number: 20580
Epoch time:      90214.35372243
Element set:     158
Inclination:       28.4686 deg
RA of node:       315.8425 deg
Eccentricity:    0.0005845
Arg of perigee:   251.8426 deg
Mean anomaly:     108.1532 deg
Mean motion:   14.84673370 rev/day
Decay rate:      3.373e-05 rev/day^2
Epoch rev:            1484

Satellite: BADR-1
Catalog number: 20685
Epoch time:      90215.25394096
Element set:      24
Inclination:       28.5009 deg
RA of node:       186.2510 deg
Eccentricity:    0.0535126
Arg of perigee:   319.5119 deg
Mean anomaly:      36.6840 deg
Mean motion:   14.97132608 rev/day
Decay rate:     2.0471e-03 rev/day^2
Epoch rev:             273
/EX
SB ALL @ AMSAT $ORBS-216.W
Orbital Elements 216.WEATHER

HR AMSAT ORBITAL ELEMENTS FOR WEATHER SATELLITES
FROM N3FKV LORENA, TX      AUGUST 4, 1990
TO ALL RADIO AMATEURS BT

Satellite: NOAA-9
Catalog number: 15427
Epoch time:      90214.30470666
Element set:     609
Inclination:       99.1702 deg
RA of node:       215.2099 deg
Eccentricity:    0.0014262
Arg of perigee:   237.9861 deg
Mean anomaly:     121.9924 deg
Mean motion:   14.12627762 rev/day
Decay rate:       2.88e-06 rev/day^2
Epoch rev:           29049

Satellite: NOAA-10
Catalog number: 16969
Epoch time:      90214.31016340
Element set:     456
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Inclination:       98.5959 deg
RA of node:       241.2203 deg
Eccentricity:    0.0014303
Arg of perigee:   132.9171 deg
Mean anomaly:     227.3210 deg
Mean motion:   14.23676806 rev/day
Decay rate:       4.47e-06 rev/day^2
Epoch rev:           20117

Satellite: MET-2/16
Catalog number: 18312
Epoch time:      90213.08863250
Element set:     468
Inclination:       82.5480 deg
RA of node:       254.6954 deg
Eccentricity:    0.0012569
Arg of perigee:   119.3220 deg
Mean anomaly:     240.9087 deg
Mean motion:   13.83665308 rev/day
Decay rate:       2.19e-06 rev/day^2
Epoch rev:           14919

Satellite: MET-2/17
Catalog number: 18820
Epoch time:      90213.00818807
Element set:     331
Inclination:       82.5469 deg
RA of node:       314.8299 deg
Eccentricity:    0.0016340
Arg of perigee:   193.8613 deg
Mean anomaly:     166.2098 deg
Mean motion:   13.84356958 rev/day
Decay rate:       2.07e-06 rev/day^2
Epoch rev:           12638

Satellite: MET-3/2
Catalog number: 19336
Epoch time:      90214.45986581
Element set:     544
Inclination:       82.5311 deg
RA of node:       244.6792 deg
Eccentricity:    0.0016232
Arg of perigee:   193.4369 deg
Mean anomaly:     166.6226 deg
Mean motion:   13.16898788 rev/day
Decay rate:       3.91e-06 rev/day^2
Epoch rev:            9704

Satellite: NOAA-11
Catalog number: 19531
Epoch time:      90214.38006495
Element set:     326
Inclination:       98.9831 deg
RA of node:       162.7448 deg
Eccentricity:    0.0012964
Arg of perigee:   148.9182 deg
Mean anomaly:     211.2741 deg
Mean motion:   14.11654711 rev/day
Decay rate:       1.99e-06 rev/day^2
Epoch rev:            9548

Satellite: MET-2/18
Catalog number: 19851
Epoch time:      90214.36519984
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Element set:     278
Inclination:       82.5229 deg
RA of node:       191.6632 deg
Eccentricity:    0.0012991
Arg of perigee:   231.1114 deg
Mean anomaly:     128.8887 deg
Mean motion:   13.83990721 rev/day
Decay rate:       3.00e-08 rev/day^2
Epoch rev:            7195

Satellite: MET-3/3
Catalog number: 20305
Epoch time:      90214.44808768
Element set:     185
Inclination:       82.5546 deg
RA of node:       185.3678 deg
Eccentricity:    0.0015133
Arg of perigee:   208.9864 deg
Mean anomaly:     151.0419 deg
Mean motion:   13.15861924 rev/day
Decay rate:       3.10e-07 rev/day^2
Epoch rev:            3703

Satellite: MET-2/19
Catalog number: 20670
Epoch time:      90214.57070160
Element set:      31
Inclination:       82.5424 deg
RA of node:       251.8511 deg
Eccentricity:    0.0016551
Arg of perigee:   152.1456 deg
Mean anomaly:     208.0591 deg
Mean motion:   13.83841624 rev/day
Decay rate:       1.50e-07 rev/day^2
Epoch rev:             493
/EX


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